We'll be starting in just a few minutes….

Tell us…

What topics are you interested in for future Peer Exchange calls?

Please send your response to the call organizers via the question box.

Better Buildings®
U.S. DEPARTMENT OF ENERGY

Better Buildings Residential Network Peer Exchange Call Series

Homes and Climate – Connecting the Dots

April 14, 2022

U.S. DEPARTMENT OF ENERGY

Agenda and Ground Rules

- Agenda Review and Ground Rules
- Opening Poll
- Residential Network Overview and Upcoming Call Schedule
- Featured Speakers
  - **Karen Maoz,** KEVALA, Inc.
  - **Bing Liu,** Pacific Northwest National Laboratory
- Open Discussion
- Closing Poll and Announcements

Ground Rules:

1. **Sales of services and commercial messages are not appropriate** during Peer Exchange Calls.
2. Calls are a safe place for discussion; **please do not attribute information to individuals** on the call.

The views expressed by speakers are their own, and do not reflect those of the Dept. of Energy.

Join the Network

Member Benefits:

- Recognition in media, social media and publications
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- One-on-One brainstorming conversations

Commitment:

- Members only need to provide *one number*: their organization's number of residential energy upgrades per year, or equivalent.

Upcoming Calls (2nd & 4th Thursdays):

- *4/28: What Does Electrification at Scale Look Like?*
- *5/12: Training, New Technology, and Workforce Recruitment and Retention Challenges*

Peer Exchange Call summaries are posted on the Better Buildings website a few weeks after the call

For more information or to join, for no cost, email bbresidentialnetwork@ee.doe.gov, or go to energy.gov/eere/bbrn & click Join

Karen Moaz

Kevala

kevala

Localizing Energy Efficiency and Electrification Solutions

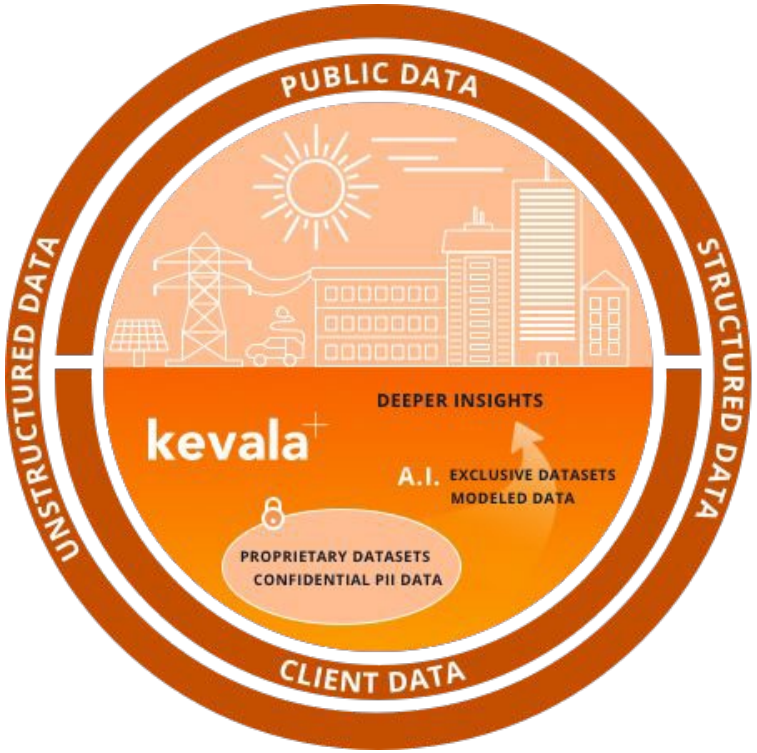
Homes and Climate - Connecting the Dots

Peer Exchange Call

April 14, 2022

About Kevala

Kevala's Assessor Platform combines hyper-granular geospatial, time-series, and relational datasets to deliver **actionable intelligence** by leveraging **proprietary analytics** and **comprehensive (public, proprietary and confidential PII) datasets** from energy markets, the built environment, and the IOT.



What is local? Why is it important?

Energy Efficiency Reporting Metrics

Is this enough for electrification?

Utility Wide
Sector Level
Climate Zone (maybe)
Annual kWh Savings
Annual GHG Reductions
Summer Peak Demand
Winter Peak Demand

Problem Statement

With increase towards decarbonization, integrating energy eiciency and electrification programs with distribution grid planning is necessary.

Demand side (EE and Electrification) forecasts historically tend to be 'allocated' using a top down approach to assess circuit load impacts

Forecasts for adoption should instead incorporate more geospatial granularity to inform short and long-term grid planning activities

Program solutions should factor in potential grid side impacts and more appropriately quantify the value based on geospatial and temporal considerations

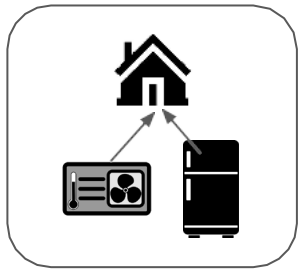
Journey to Building Electrification

Energy efficiency and electrification programs also need to address market barriers

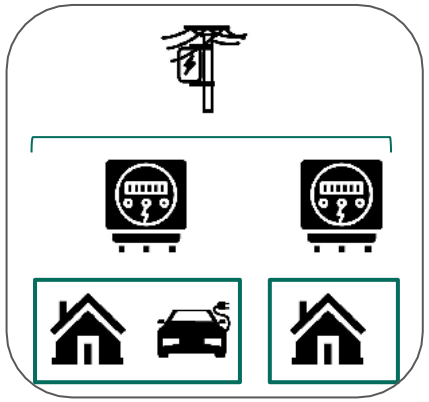
Customers	Regulatory	Utility
• **Imperfect Information** o Costs - Navigating the different costs such as technology, labor, panel/infrastructure upgrades, incentive availability*, etc. o Performance risk o Energy savings or bill impacts* • **Split incentives** o Landlord / tenant • **Market structure** o Equipment manufacturer and supplier constraints o Contractor identi cation • **Externalities** o Assessing GHG benefits*	• **Defining new metrics** o Paradigm shift beyond kWh, peak kW, and therms* • **Benefit cost analysis*** • **Setting appropriate targets*** • **Fuel switching policies**	• **Removing Silos*:** Shift from top-down planning process of generation, poles, and wires to a bottom-up premise level load and DER forecasting model • **Assessing Grid Needs*:** Gain insights into the needs of the distribution grid and identify circuit level changes due to increased adoption • **Coordinating Electric and Gas*:** Address stranded gas infrastructure and prioritize electric grid deferment or capacity expansion needs

Areas impacted by grid planning effort

So what is different for energy efficiency & electrification planning



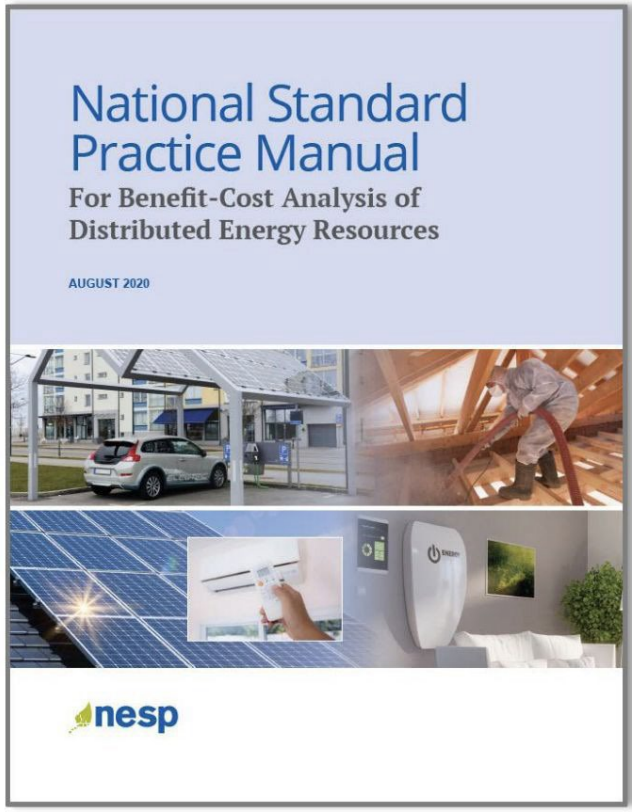
- Traditionally, EE (and BE) planning is bottom up
- Quantify type and density of technologies in each building type
- However, impacts are typically allocated from system level to feeders/substations using an imprecise top down (peanut butter) approach



- Alternative is forecast at the premise/customer level
- Kevala is currently implementing this approach in California and will have lessons learned on the value of the grid planning from a bottom-up vs. top down approach

Unpacking the Value

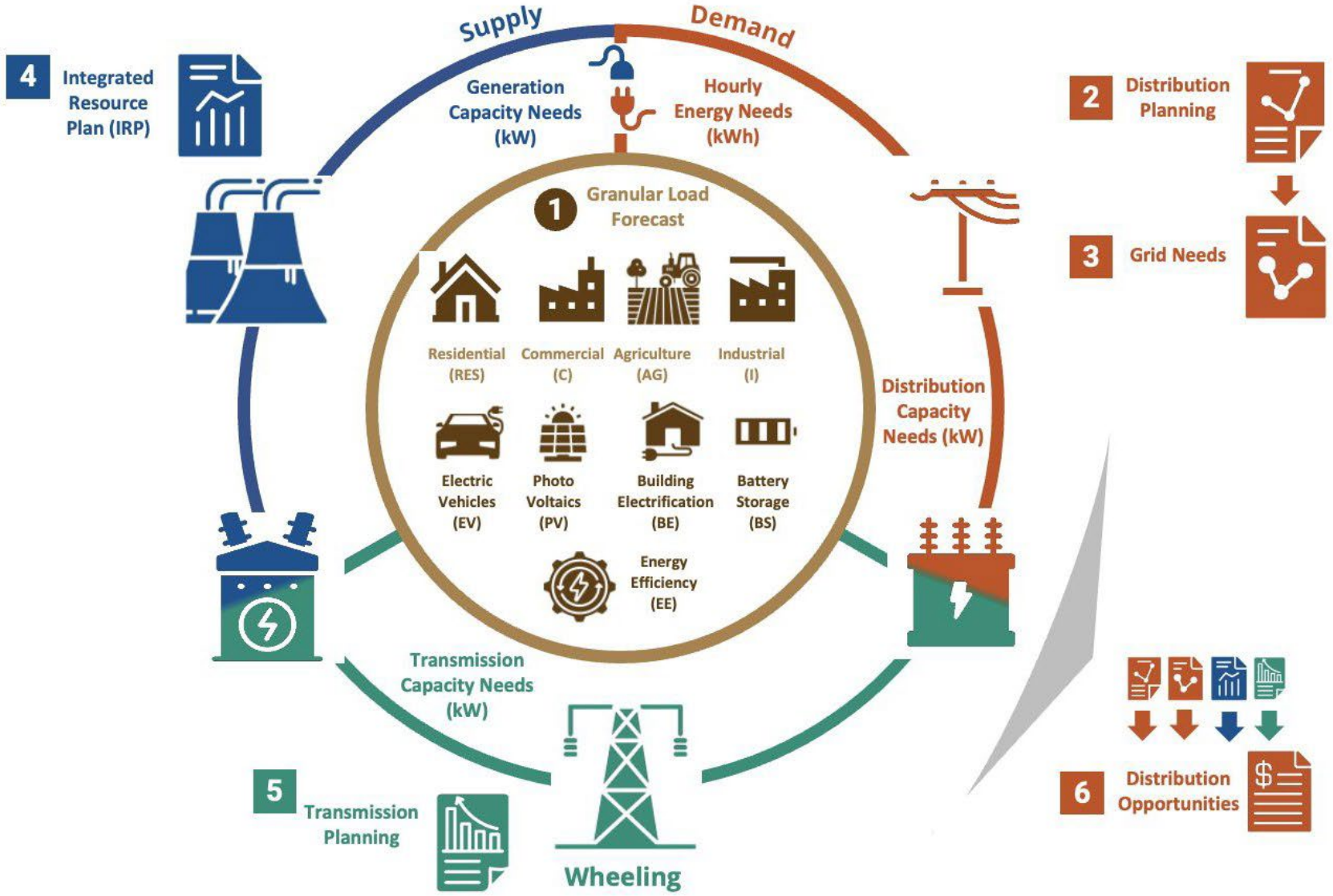
- Metrics need to capture localized value of DERs and be aligned with grid planning needs
- Key questions to be addressed include
  - Can the grid handle localized electrification?
  - Does electrification reduce emissions? What is that value?
  - How local does the analysis need to be?
- The NSPM provides a framework for establishing policies and flexibility for valuing the benefit and cost of DERs at the localized level



Potential Electrification Grid Integration Process

Illustration of the integrated grid planning using granular load forecast

1. *Planning process starts with granular load forecast including expected DERs*
2. *Distribution planning uses granular loads and resource needs by location to determine demands at interconnections with transmission*
3. *The distribution grid requirements analysis uses load & DER resources needs*
4. *The IRP uses the distribution loads and baseline assumptions for the current transmission grid to identify generation dispatch and supply expansion needs*
5. *Transmission planning typically uses distribution loads to quantify power flows and identify constraints and incremental transmission needs*
6. *Using results of the assessments can help identify distribution opportunities and creating a comprehensive least cost plan*



kevala

Quantifying Localized Value

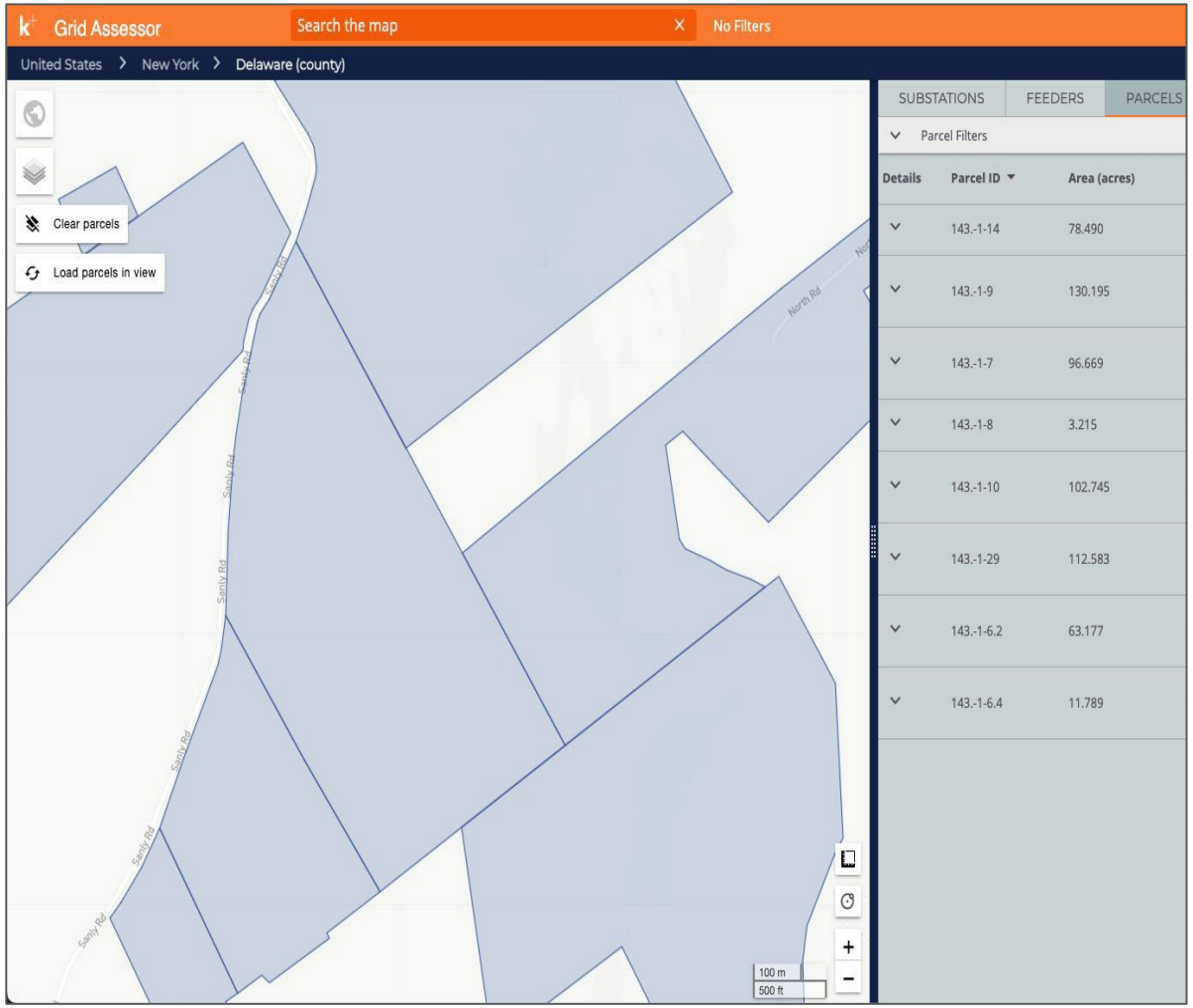
Multifaceted and defined by stakeholder representation

- Valuing market intervention and impacts require granular data and distribution grid modeling
- Utility and regulatory definitions for programs should correlate to value for the grid beyond traditional metrics of uniform energy and capacity avoided costs which are independent of local and time-based values
  - GHG emissions abated
  - Distribution grid needs (deferred or expanded)
  - Cost of operation defined

Current values used in portfolios

- Avoided energy and capacity costs
- Levelized cost of energy
- NPV of net benefits (similar to CA total system benefits)
- Net tons of CO_2 equivalent
- Marginal abatement cost

Equity Opportunities in Local Valuation



1. Model power flows through substations, feeders, circuits, and to parcels.
2. Overlay onto maps: energy burden census map and polygons indicating minority, low-income, and english isolated groups.
3. Identify overlapped grid needs with energy justice metrics to increase transparency, equity, and access for rates, program delivery, and other offerings.
4. Set appropriate value with the data.

Than you

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Bing Liu

Pacific Northwest National Laboratory

U.S. DEPARTMENT OF ENERGY

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Better Buildings Residential Network

Homes and Climate – Connecting the Dots

Rethinking Efficient Homes

Bing Liu

April 14, 2022

U.S. DEPARTMENT OF ENERGY BATTELLE

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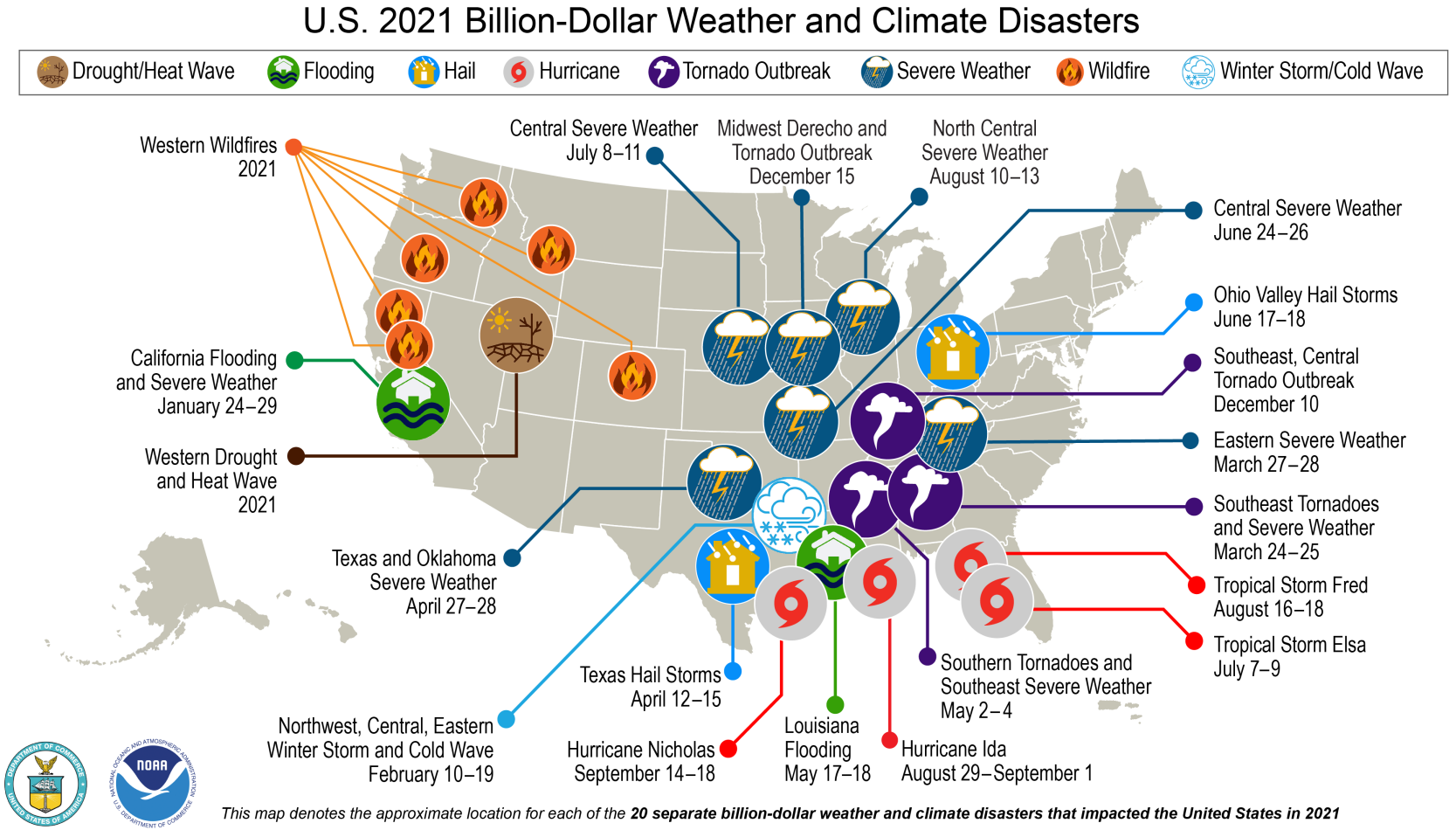
Climate we are facing…



2021

20 events

$148B cost

724 deaths

2020

22 events

$95B cost

262 deaths

2000s (2000-2009)

6.7 events

$56B cost

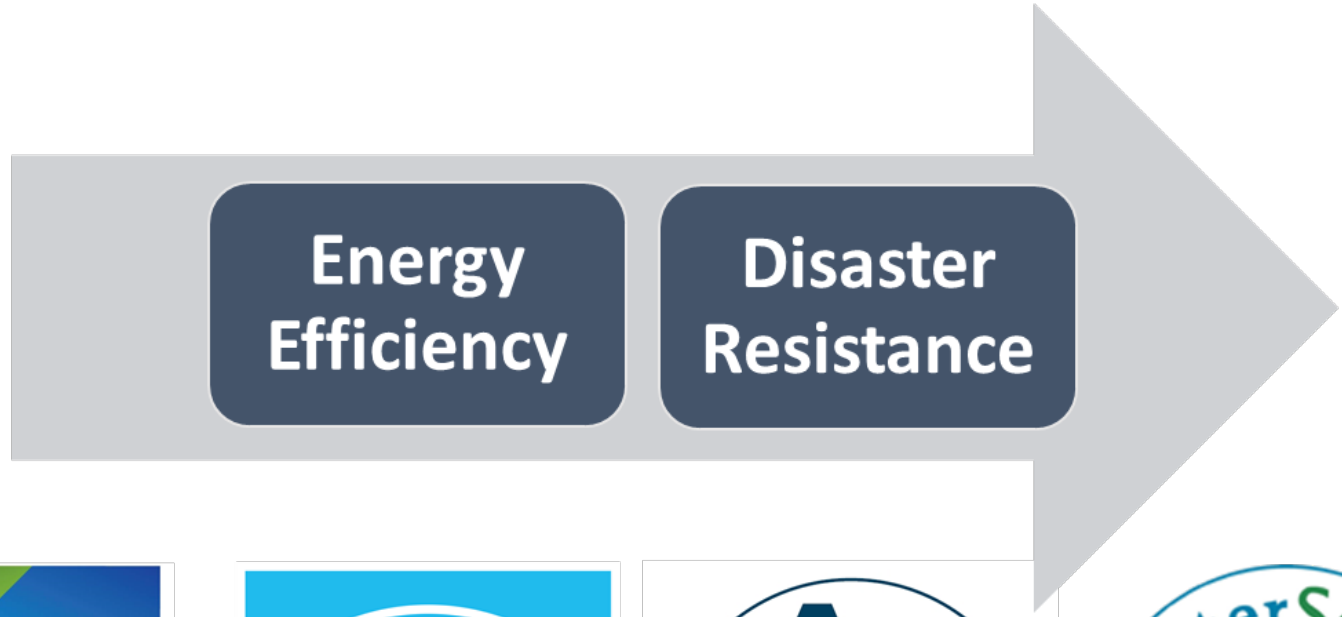
310 deaths

Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2022).

IMPACTS OF CLIMATE CHANGE


“Building a resilient home that can deal with the consequences of climate change is becoming an important consideration when building any new home….as homebuilders, perhaps we are the ones who should proactively address these challenges.”
--Thrive Home Builders

EE homes are (mostly) disaster-resistance



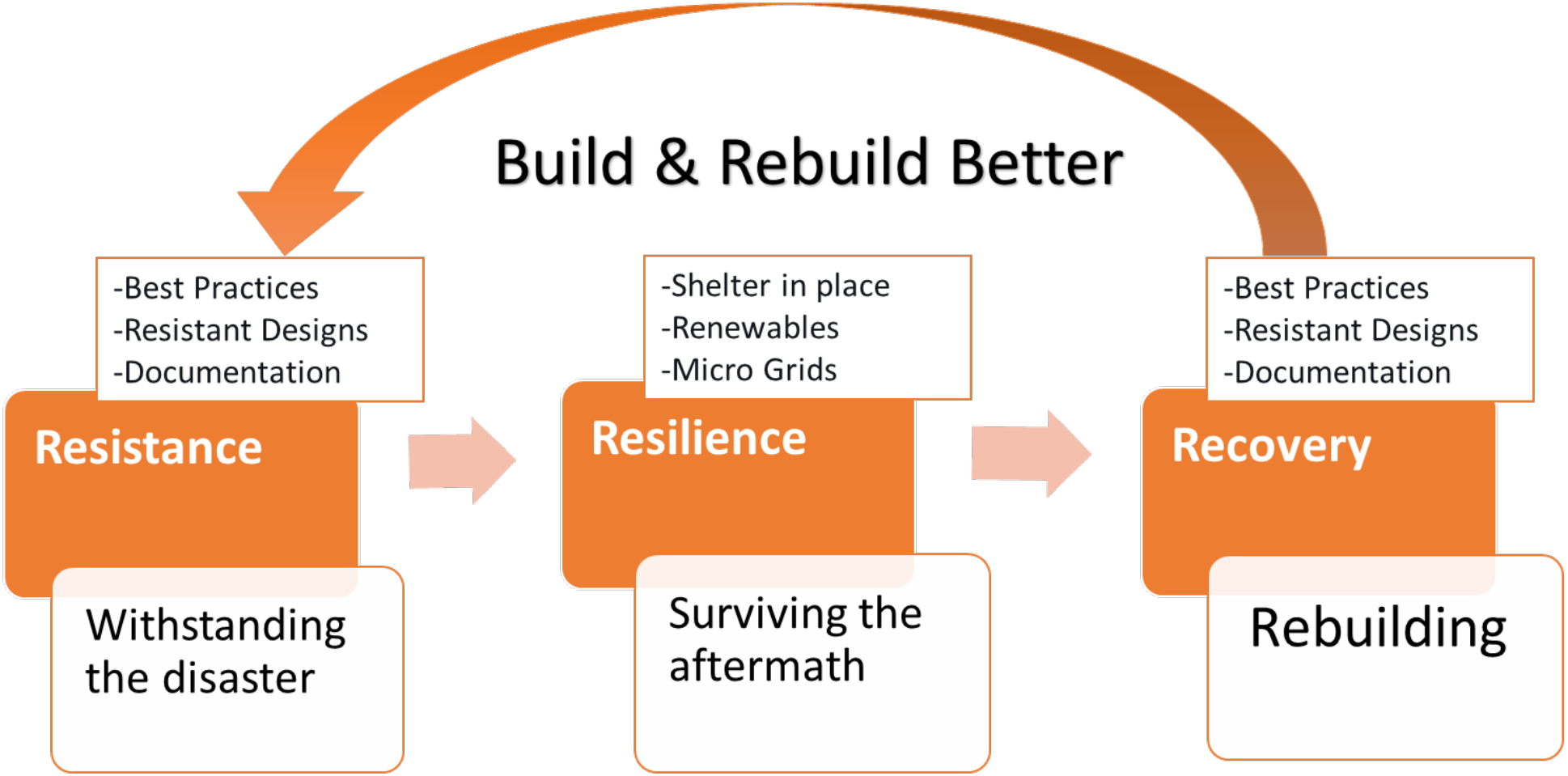
ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY

ENERGY STAR

EPA Indoor airPLUS QUALIFIED HOME

WaterSense Meets EPA Criteria

Builders play a fundamental role



Building for Disaster Resistance - A DOE ZERH Example

Light-colored exterior walls, Cool Roof-certified asphalt shingles, and overhangs keep interiors cooler even if the power goes out.

CMU walls built to withstand winds up to 160 mph

EE double-pane, low-e, vinyl-framed windows have impact-rated glasses so storm shutters are not needed

Continuous rigid foam interior wall insulation and 5.5 inches of spray foam on the underside of roof limit heat transfer to retain even temperatures inside even without power

"Because we comply with the DOE ZERH program, we feel we are building 100+ year homes."
- Habitat for Humanity of S. Sarasota County, Florida

Building for Disaster Resistance (cont'd)

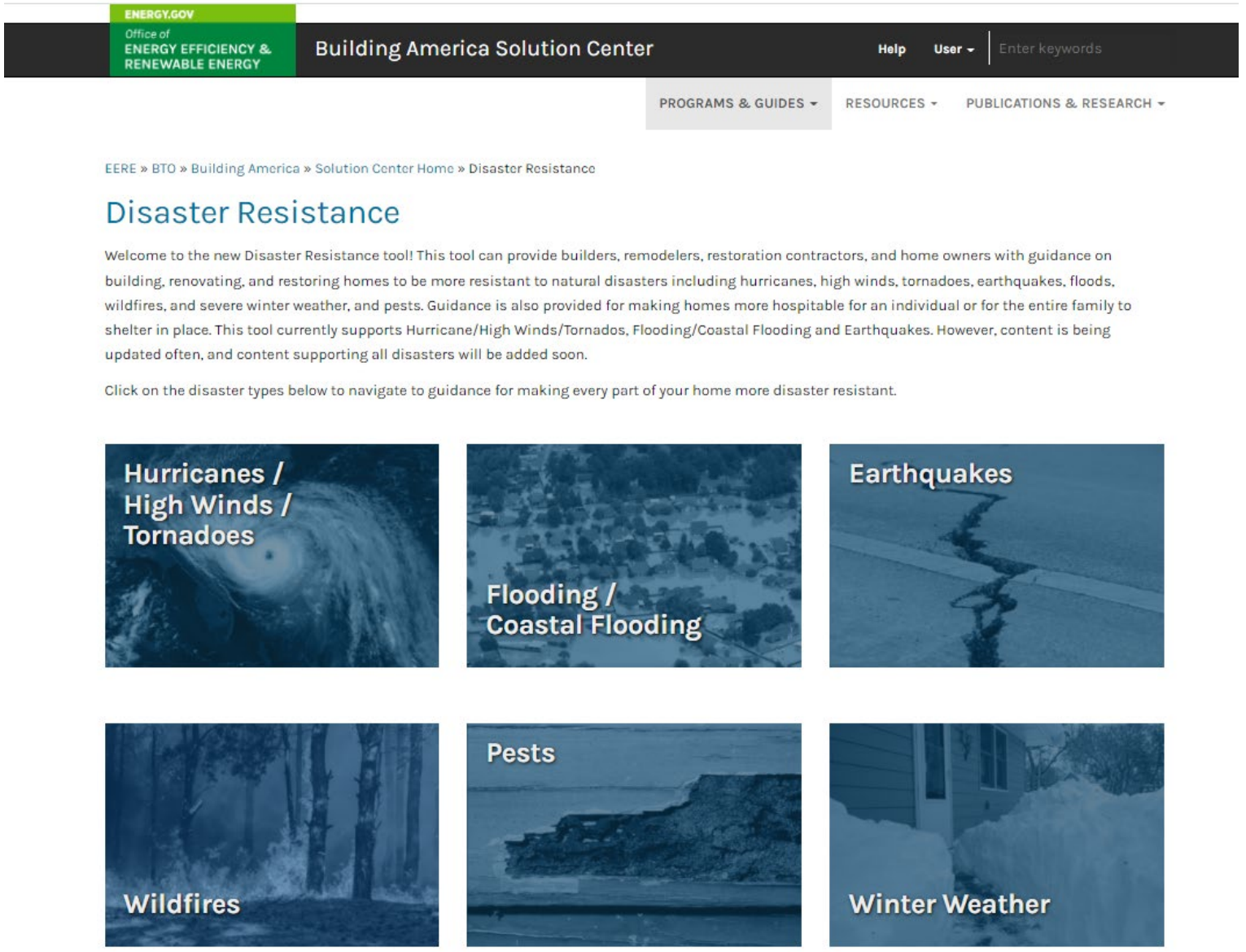
ENERGY STAR-labeled appliances, EPA WaterSense-compliant fixtures, high-efficiency HVAC, water heating, and lighting all help to reduce power and water usage

Ceiling fans help reduce the need for air conditioning

Extensive air sealing also keeps out heat and humidity as well as wildfire smoke, pollen, dust, and pests

"The biggest reward is talking with a homeowner after they have lived in the home for a few months and seeing the smile on their face. The satisfaction that comes from knowing we did our best to build a beautiful, durable, safe, and efficient home for a family in need is priceless."
- Habitat for Humanity of S. Sarasota County, Florida

Disaster Resistance Tool



Tool Homepage
BASC.pnnl.gov/disaster-resistance

Tool Organization

- Overview
- Design
- Roof
- Walls / Windows / Doors
- Building Attachments
- Foundation / Site
- Operations / Equipment

Walls

- Moisture-, Impact-, Fire-, and Pest-Resistant Exterior Siding

  Guide describing how to select the siding materials best suited to withstand hazards the home is likely to face within its lifetime.

- Fire-Resistant Wall Assemblies

  Guide describing wall assemblies and materials that are resistant to destruction from wildfires.

Windows

- Windows Have Impact-Rated Glass, Fire-Resistant Glass, or Protective Coverings

  Guide describing how to strengthen or protect windows against wind and wind-borne debris during high-wind events including hurricanes and tornados.

Doors

- Exterior Doors Are Insulated, Impact Rated, and Fire Rated

  Guide describing the use of doors that are impact rated or have protective coverings in hurricane and high wind zones.

Design Guides

- Overview
- Design
- Roof
- Walls / Windows / Doors
- Building Attachments
- Foundation / Site
- Operations / Equipment

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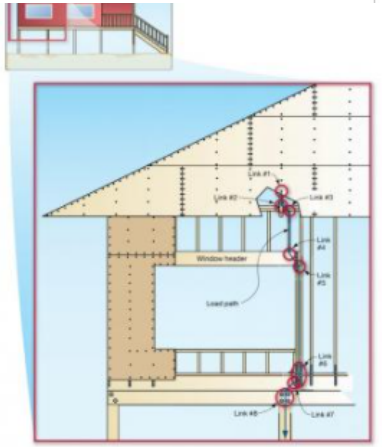
Continuous Load Path Provided with Connections from the Roof through the Wall to the Foundation

Print

Scope | Description | Success | Climate | Training | CAD | Compliance | Retrofit | More

Description



Provide a strong and continuous load path from the roof to the foundation to avoid structural damage and to keep the building intact during hurricanes and other extreme storms.

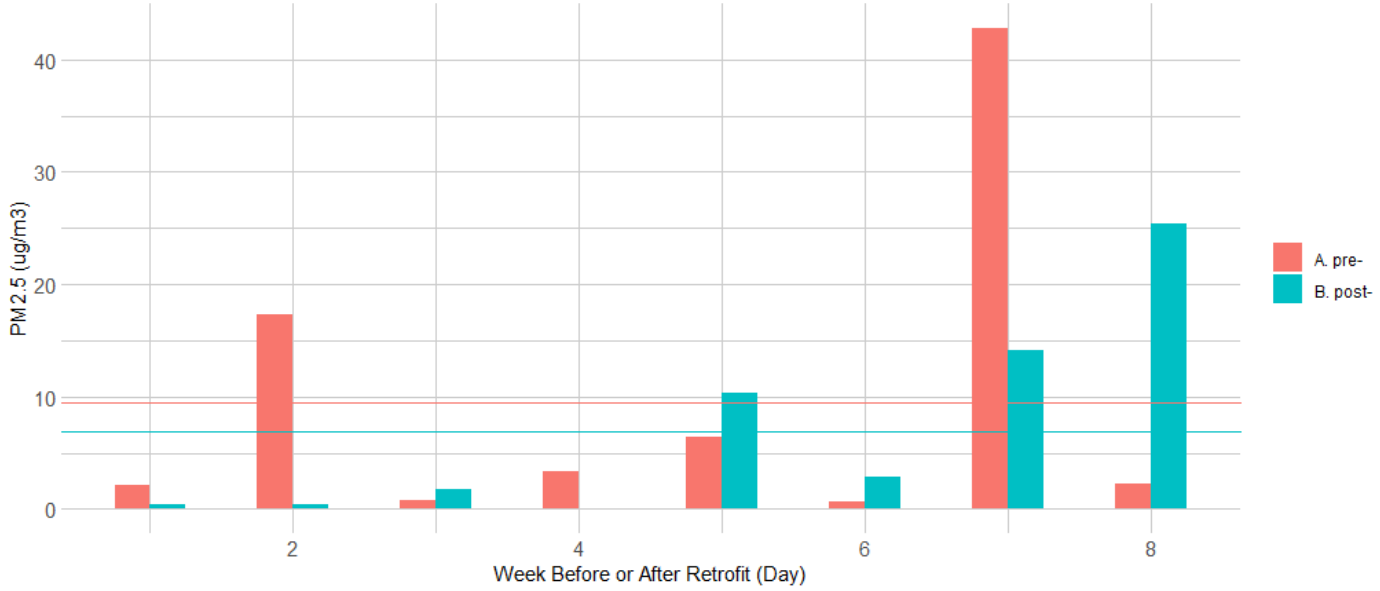
Best practice steps for new construction:

- Determine the wind design velocity and if the house is in a hurricane-prone region.
- For hurricane-prone regions, a licensed structural engineer must determine the continuous load path connections.
- For areas where design wind speed is less than that of hurricane-prone regions, a prescriptive design approach may be used:
  - Ensure that roof framing, floor framing, wall framing, and foundations are constructed in accordance with all applicable building codes.
  - Specify and install a continuous load path, such that the building has positive connections from the roof to the foundation to resist and transmit wind uplift and lateral shear loads to the ground (see Description tab for above-code connectors):
    - Install roof sheathing-to-framing connections
    - Install roof-to-wall connections
    - Install wall above-to-below connections
    - Install wall-to-foundation connections
    - Install any chimney-to-roof member connections.

See the Compliance Tab for related codes and standards requirements, and criteria to meet national programs such as DOE's Zero Energy Ready Home program, ENERGY STAR Certified Homes, and EPA Indoor airPLUS.

Last Updated: 2020-09-24

Energy Retrofits and Health



Low-cost consumer products (<$250/ea) can deliver data to retrofit programs, implementors, and researchers to be used for program validation, research, etc.

- Collect data in 150 homes in the Midwest
- Low-cost monitoring does not lead to reliable results, but aggregated samples may provide insights to implementors
- Create data collection methodology, validate the use of low-cost monitoring from the programmatic perspective, and examine insights from data collection.

To Recap

- Energy efficient homes provide resiliency infrastructure, increased protection and health for occupants
- Need to communicate the benefits to consumers that they care most about
- Use tools and resources available to build disaster-resistant homes
- Energy equity is a critical factor when considering access to energy efficient, green homes and technologies

Thanks to My PNNL Colleagues

Dr. Chrissi Antonopoulos

Senior Analyst

Terri Gilbride

Social Scientist

Sam Rosenberg

Data Scientist

Cheryn Metzger

Residential Program Manager

BIG PICTURE

energy-efficient homes = climate-resilient infrastructure

Pacific Northwest
NATIONAL LABORATORY

Thank you

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Explore the Residential Program Solution Center

Resources to help improve your program and reach energy efficiency targets:

- Handbooks - explain *why* and *how* to implement specific stages of a program.
- Quick Answers - provide answers and resources for common questions.
- Proven Practices posts - include lessons learned, examples, and helpful tips from successful programs.
- Technology Solutions NEW! - present resources on advanced technologies, **HVAC** & **Heat Pump Water Heaters**, including installation guidance, marketing strategies, & potential savings.

https://rpsc.energy.gov

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